Chapter 3

Affected Environment and Environmental Consequences

Chapter 3 is an inventory of the affected environment and a discussion of consequences and potential mitigation measures resulting from the alternatives retained for detailed study. It succinctly describes the physical, biological, social, and economic environments of the area to be affected by the alternatives. It describes the impacts of the alternatives; the adverse effects that cannot be avoided if implemented; the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity; and any irreversible or irretrievable commitments of resources that would result if an alternative is implemented (40 CFR part 1502.16).

A study area of approximately 34,416 acres (approximately 54 square miles), encompassing the range of reasonable alternatives, was identified and a detailed analysis of its natural, social, and economic features was performed.

This chapter identifies the affected environment, potential environmental consequences, mitigation measures, and commitments associated with construction and operation of the No-Build Alternative and build alternatives retained for further consideration and detailed analysis. Potential impacts – both beneficial and adverse – were identified and, where possible, quantified through studies of the natural, social, and economic environments. Potential impacts include the direct impacts, indirect or secondary impacts, and cumulative impacts of the No-Build Alternative and build alternatives.

3.1 Physical and Biological Environment

The physical geography, or physiography, of an area is a description of physical features of the natural

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landscape. The following subsections describe the physical geography, climate, soils, and geology of the study area that may influence the alternatives development and selection process.

Direct Impacts — the immediate effects on the social, economic, and physical environment caused by the construction and operation of a highway. These impacts are usually experienced within the right-of-way or in the immediate vicinity of the highway or another element of the proposed action (40 CFR 1508.8(a)).

Indirect (or Secondary) Impacts — the impacts that are caused by the project and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR 1508.8(b)).

Cumulative Impacts — the impacts on the environment that result from the incremental impact of a project when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR 1508.7).

3.1.1 Physical Geography

The study area is in the Central Maine Embayment biophysical subregion.[1] the study area has a rolling to hilly topography, with steep inclines and expansive wetlands in lower-lying areas. Elevations in the study area generally range between zero and 1,000 feet above sea level (USGS, 2003).

The No-Build Alternative would not impact the physical geography of the study area.

The build alternatives would not substantially alter the physical geography of the study area. The build alternatives were designed to follow the existing terrain while adhering to the MaineDOT's design criteria for grades and slopes for freeways. The earthwork necessary to construct the build alternatives is balanced (i.e., no substantial borrowing or wasting of earth material from/at other sites is necessary).

3.1.1.1 Climate

The state of Maine is divided into three major climatological divisions: Coastal Division, Southern Interior Division, and Northern Interior Division. The study area is located in the Southern Interior Division, which encompasses approximately 30 percent of

[1]A type of classification system based on patterns in the landscape and vegetation to categorize Maine's landscape set forth by Janet McMahon in her MS thesis in 1990 that was adopted by the Maine Forest Service.

Maine. Peak summer temperatures average 70 degrees Fahrenheit (F) statewide, but temperatures can reach 90 degrees F. Winters in the Southern Interior Division can reach temperatures below zero degrees F. Average annual rainfall in the Southern Interior Division is 42 inches. Heavy fog can occur in low-lying areas. Average annual snowfall in this division is 60 to 90 inches (Maine Tourism Association, 2008).

The No-Build Alternative and build alternatives would not impact the climate of the study area.

3.1.1.2 Soils

The predominant glacial sediment in the study area is till, which is commonly a blanket deposition that conforms to the bedrock surface (Loiselle, 2003). Till is generally an unstratified, heterogeneous mixture of sand, silt, clay, and gravel. Glacial marine deposits, composed of dark blue to gray silt, clay, and very fine sand, are present in the study area. Small areas of ice contact deposits are present along the Penobscot River and near East Holden. They consist of well to poorly stratified deposits of sand, gravel, cobbles, boulders, and some silt and clay. Swamp deposits, found in the central and eastern portions of the study area, consist of peat, silt, clay, and sand and are poorly drained (Prescott, 1966). Thickness of the glacial deposits can be highly variable but is expected to range between zero and 50 feet in the study area (Caswell and Lanctot, 1978).

Many different soil types are found in the study area. Certain soil types can be classified as either hydric soils, which are characteristic of wetlands areas, or prime or potential prime farmland soils (exhibit 3.1). Hydric soils are saturated, flooded, or ponded long enough during the growing season to develop at least temporary conditions in which there is no free oxygen in the soil around roots. Hydric soils are developed under sufficiently wet conditions to support the growth and regeneration of hydrophytic vegetation. The prevalence of hydrophytes and presence of hydric soil reflect the long-term hydrology and are generally useful indicators of wetlands. Hydric soils are evenly distributed throughout the study area, but most are prevalent near Davis Pond and Holbrook Pond. According to the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), hydric soils comprise approximately 8,440 acres (24.5 percent) of the study area.

Prime farmland soil has the best combination of physical and chemical characteristics for producing forage and crops. Potential prime farmland refers to soils that must be drained, irrigated, or both to be classified as prime farmland. The U.S. Farmland Protection Policy Act (FPPA) (7 USC §§ 4201-09) was enacted to prevent the unnecessary or irreversible

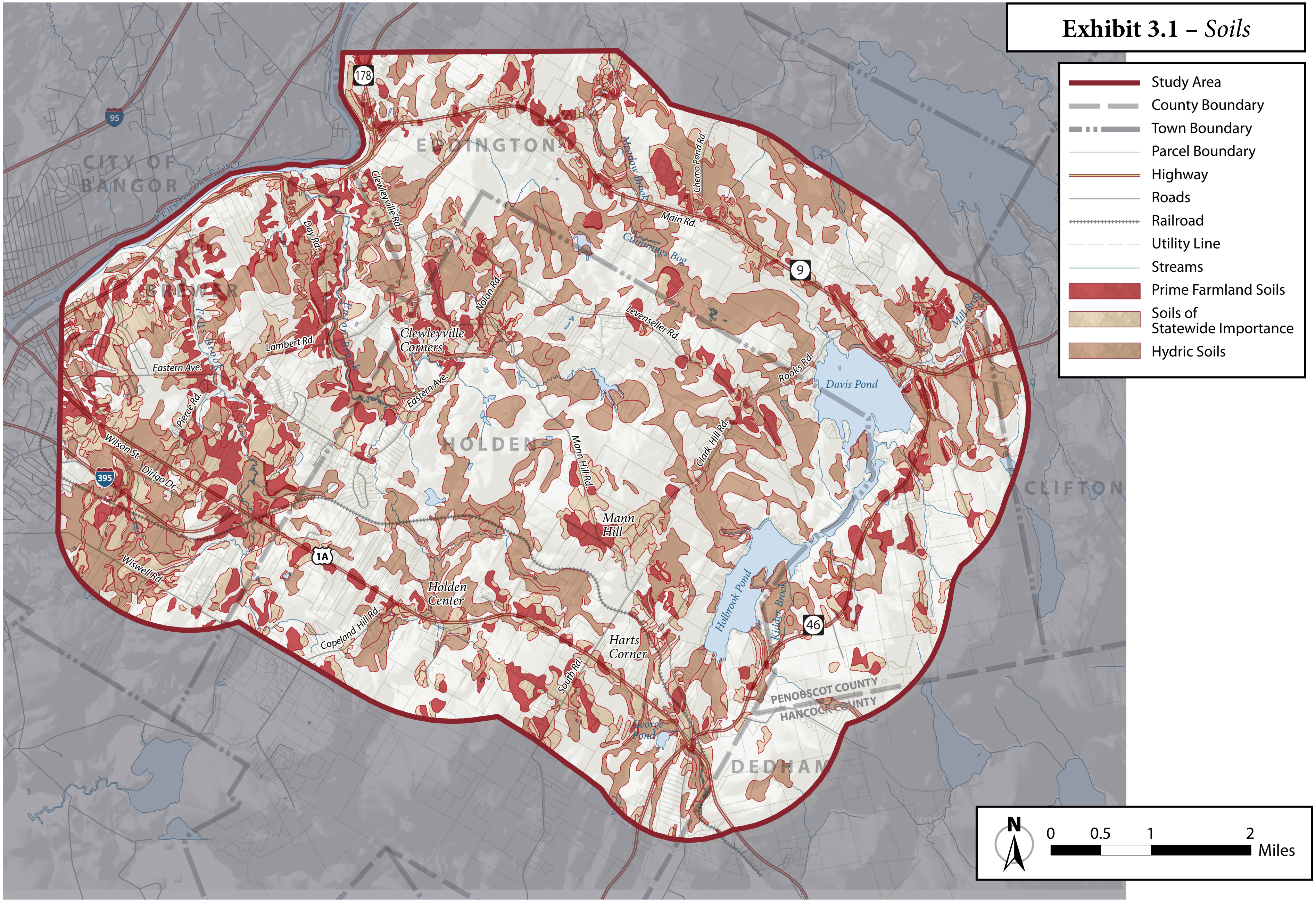


Exhibit 3.1 – Soils
Study Area
County Boundary
Town Boundary
Parcel Boundary
Highway
Roads
Railroad
Utility Line
Streams
Prime Farmland Soils
Soils of Statewide Importance
Hydric Soils
0
0.5
1
2
Miles
N
CITY OF BANGOR
EDDINGTON
BREWER
HOLDEN
CLIFTON
DEDHAM
PENOBSCOT COUNTY
HANCOCK COUNTY
Clewleyville Corners
Mann Hill
Holden Center
Harts Corner
Davis Pond
Holbrook Pond
Cummings Bog
Penobscot River
Clewleyville Rd.
Day Rd.
Lambert Rd.
Eastern Ave.
Pierce Rd.
Wilson St.
Dirigo Dr.
Wiswell Rd.
Copeland Hill Rd.
South Rd.
Mann Hill Rd.
Clark Hill Rd.
Rooks Rd.
Levenseller Rd.
Nolan Rd.
Main Rd.
Chemo Pond Rd.
Kidder Brook
Mill Brook
95
395
178
9
1A
46

conversion of these soil types to nonagricultural uses, even if the soils are not necessarily in agricultural use. Prime farmland soils in the study area are primarily in Brewer and along I-395 and Routes 1A and 9. Some of the active farmland in the study area contains prime farmland soils. Approximately 2,473 acres (seven percent) of the study area consists of prime and potential prime farmland soils.

Unique farmland is defined by the FPPA as land that is particularly suited to growing specific crops or other agricultural products. An example is a cranberry bog, which is uniquely suited to growing cranberries but may not be suitable for general agricultural uses. No unique farmland was identified in the study area.

Soils of statewide importance are defined as "… land, in addition to prime and unique farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oilseed crop. Additional soils of statewide importance include those that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce as high a yield as prime farmlands if conditions are favorable" (Council on Environmental Quality, 1980).

Approximately 4,087 acres (11.9 percent) of the study area consists of soils of statewide importance. However, many areas of the soils exist in residential development and are not considered either prime and unique farmland or soils of statewide importance under the FPPA.

The No-Build Alternative would not impact hydric soils, prime farmland soils, soils of statewide importance, or farm operations.

The build alternatives would impact hydric soils, prime farmland soils, and soils of statewide importance (exhibit 3.2).

The build alternatives would impact agricultural land through the acquisition of property and conversion to transportation use.

The No-Build Alternative and build alternatives would not result in a substantial impact to farmland and farming operations. The MaineDOT, the FHWA, and the NRCS performed an analysis of the potential impacts of the build alternatives to farmland and farming operations in accordance with the FPPA; Form NRCS-CPA-106 was completed. The build alternatives result in scores from 49 to 57 of a possible 260. Because the scores for the build alternatives are

Exhibit 3.2 – *Impacts to Soils with Special Status (acres)*

Alternative	*Hydric Soils*	*Prime Farmland Soils*	*Soils of Statewide Importance*
No-Build	–	–	–
2B-2/the Preferred Alternative	23 (0.3%)	19 (0.8%)	14 (0.3%)
5A2B-2	24 (0.3%)	14 (0.6%)	34 (0.8%)
5B2B-2	25 (0.3%)	19 (0.8%)	19 (0.4%)

less than 160, no further coordination is required to demonstrate compliance with the FPPA.

Construction of the build alternatives would require the removal of vegetation and earth-moving activities, thereby exposing soil to erosive forces. Construction precludes the use of functioning soil for other uses such as native vegetation support. During construction, sediment- and erosion-control procedures to control both coarse and fine sediment would be implemented. These measures would be in accordance with Section II of MaineDOT's *Best Management Practices Manual for Erosion and Sedimentation Control* (MaineDOT, 2008a).

3.1.1.3 Geology

Most of the study area is underlain by Devonian and Silurian Age metasediments that have undergone several episodes of tectonic folding and faulting (Kaszuba, 1992). Bedding (i.e., layers of rock) in the area is generally vertical to near vertical and strikes northeast-southwest. Cleavage (i.e., the tendency of rocks to break or fracture in a plane or direction) also strikes northeast-southwest and is high angle to vertical. The Norumbega fault zone strikes northeast-southwest through the center of the study area. Blanketing the bedrock is a highly variable layer of glacial sediments (Prescott, 1966).

The northwestern half of the study area, located between the Penobscot River and the Norumbega fault zone, is underlain by the Sangerville formation; the Vassalboro and Fall Brook formations; and the "Kenduskeag Unit" a subgroup of the Vassalboro formation. The Sangerville formation is a graded calcareous quartzite interbedded with dark gray to black phyllitic slate. The Vassalboro and Fall Brook formations are composed of thick, fine- to medium-grained, feldspathic wacke with 3- to 6-inch-thick interbeds of phyllite and coarse sand to granule conglomerate. The Kenduskeag Unit is a sequence of massive quartzite alternating with sequences of thin interbeds of phyllite and metasiltstone. Portions of the unit consist of sedimentary breccia and chaotic zones of slump origin (Griffin, 1976).

The Bucksport formation underlies most of the study area southeast of the Norumbega fault zone (Osberg et al., 1985). The formation is composed of interlaminated pelite and calcareous siltstone. The Copeland formation is present along the southern edge of the study area near Holden and is composed of interlayered beds of bluish-gray pelitic schist and quartzite (Wones, 1991; Kaszuba, 1992).

The No-Build Alternative and build alternatives would not impact geological resources that would require extraordinary engineering solutions.

3.1.2 Aquatic Resources

Aquatic resources consist of surface water and groundwater used as a source of drinking water, surface water used as habitat, and transitional lands affected by surface water and groundwater (e.g., wetlands and floodplains).

Water resources in the study area consist of groundwater and surface water such as rivers, streams, and ponds. Some of these water resources serve as a source of primary drinking-water supply for area residents. Water resources may be affected directly or indirectly by construction. Federal and state environmental laws and regulations provide protection of water resources because they are important in supporting aquatic habitat and provide critical functions, such as flood control and water supply.

3.1.2.1 Water Resources

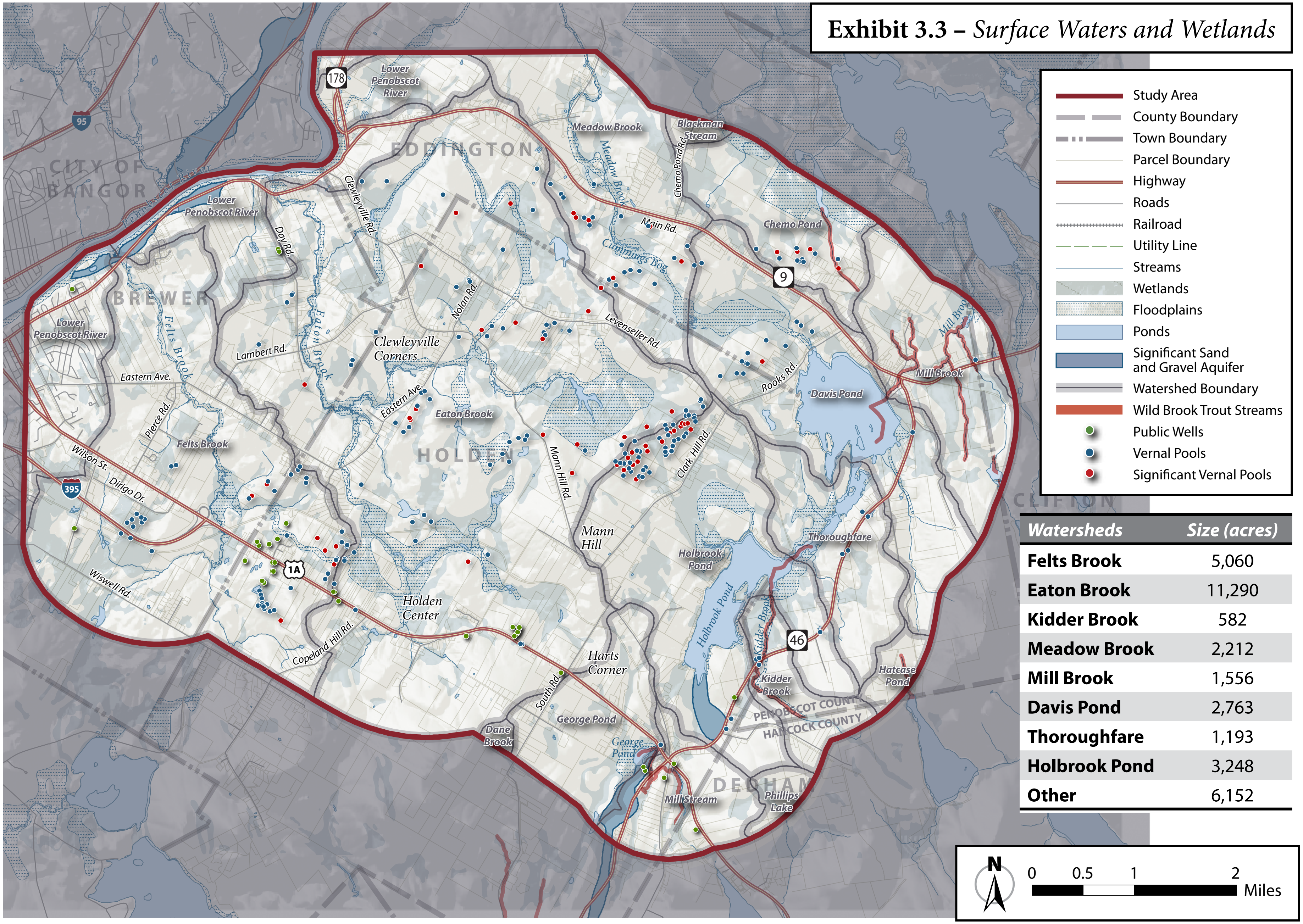
Surface Waters. The predominant surface-water features in the study area are the Penobscot River, Felts Brook, Eaton Brook, Kidder Brook, Meadow Brook, Mill Brook, Davis Pond (also known as Eddington Pond), and Holbrook Pond (exhibit 3.3). The study area is located in the Lower Penobscot River watershed; many sub-watersheds are also located in the study area.

The Penobscot River and the waters of its contributing drainage basin are classified as Class B waters (exhibit 3.4). The Maine Department of Environmental Protection (MDEP) is responsible for protecting these water classifications. Additionally, the Maine legislature ruled that the free-flowing habitat of the segment of the Penobscot River in the study area provides irreplaceable social and economic benefits and that this use must be maintained [38 MRSA § 467-7A (5), (6), and (7)].

At 350 miles long, the Penobscot River is the longest river in Maine. The Eastern and Western Branches of the Penobscot River converge at the town of Medway. The river flows south past the study area to Penobscot Bay.

Felts Brook, approximately 5.3 miles long, begins to the south and east of the I-395/Route 1A interchange, flows to the north and west, and ultimately discharges into the Penobscot River in Brewer. Felts Brook averages approximately 20 feet in width and two feet in depth near the I-395/Route 1A interchange. Its short steep banks are prone to slumping along meanders or where vegetation is sparse. Although the upper and lower reaches of Felts Brook are well shaded, the central portion receives considerable sunlight because it flows largely through land where woody riparian vegetation has been removed. The central and lower portion of Felts Brook has a silty substrate with few rocks and cobbles and a low gradient.

Exhibit 3.3 – *Surface Waters and Wetlands*



Watersheds	Size (acres)
Felts Brook	5,060
Eaton Brook	11,290
Kidder Brook	582
Meadow Brook	2,212
Mill Brook	1,556
Davis Pond	2,763
Thoroughfare	1,193
Holbrook Pond	3,248
Other	6,152

Exhibit 3.4 – *Maine Standards for Classification of Fresh Surface Waters*

Classification	Class	Designated Uses	Habitat	Aquatic Life/Bacteria	Discharge of Pollutants
1	**AA**	Drinking water after disinfection, fishing, recreation and navigation, habitat for aquatic life	Free-flowing and natural	As naturally occurs	None allowed, except stormwater
2	**A**	All uses of AA, hydroelectric power generation, industrial process and cooling water supply	Natural	As naturally occurs	Permitted only if effluent will be equal to or better than the water quality of receiving waters
3	**B**	Same as Class A	Unimpaired	Mean amount of bacteria of human origin may not exceed 64 ppm	Receiving waters shall be of sufficient quality to support all aquatic species indigenous to the receiving waters
4	**C**	Same as Class A	Unimpaired	Mean amount of bacteria of human origin may not exceed 142 ppm	May cause some changes to aquatic life, but receiving waters must be of sufficient quality to support all aquatic species indigenous to the receiving waters

Source: *Maine Public Law, Standards for Classification of Fresh Surface Waters, 38 MRSA §465.*

The main stem of Eaton Brook, approximately 6.8 miles long, begins near Copeland Hill Road in Holden, flows to the north and ultimately discharges into the Penobscot River in North Brewer. Eaton Brook is approximately 15 to 20 feet wide and averages approximately 18 inches deep. The upper reaches of Eaton Brook are well shaded with generally well-defined banks and low flow. Eaton Brook also exhibits low gradient. The lower reaches are well shaded with defined banks and slightly greater flow. There are several well-defined pools in the lower reaches of Eaton Brook. It has many well-defined tributaries that extend several miles through the central and north-central portions of the study area.

Kidder Brook, approximately 2.3 miles long, begins to the east of Route 46 and crosses under it before discharging into Holbrook Pond. Kidder Brook has a dense forest canopy and exhibits a higher gradient compared to Felts Brook and Eaton Brook. It is typically six to 12 feet in width and exhibits a series of stepped pools and riffles east of the crossing at Route 46. West of Route 46, Kidder Brook exhibits lower gradient and meanders to its confluence with Holbrook Pond.

Meadow Brook is approximately eight feet wide and is an outlet of Davis Pond. From Davis Pond, Meadow Brook flows northwest through Cummings Bog, out of the study area, and empties into the Penobscot River approximately 4 miles north of the Routes 9 and 178 intersection. Meadow Brook is approximately 11.8 miles long. In the study area, it flows mainly through undeveloped forested land.

Mill Brook is approximately 20 feet wide and also is an outlet of Davis Pond. From Davis Pond, Mill Brook flows north approximately 1.9 miles to its confluence with Chemo Pond. In the study area, Mill Brook flows mainly through forested areas until north of East Eddington along the Eddington-Clifton town line, where it meanders through an open marsh area before entering Chemo Pond.

Davis Pond and Holbrook Pond are located on the Holden–Eddington town line. Holbrook Pond is a warmwater pond approximately 350 acres in size, with a maximum depth of 28 feet (PEARL, 2005). Davis Pond is approximately 415 acres in size and has a maximum depth of 14 feet. It is connected to Holbrook Pond by a marshy area known as the "Thoroughfare" (PEARL, 2005). Both Davis Pond and Holbrook Pond are classified as Class GPA waters (38 MRSA § 465A) (exhibit 3.5).

Davis Pond and Holbrook Pond are on the MDEP list of lakes most at risk from new development (MDEP, 2006). In Maine, a lake is considered most at risk from new development if it is:

- a public water supply
- identified by the MDEP as being in violation of class GPA water-quality standards or as particularly sensitive to eutrophication based on:
    - » current water quality
    - » potential for internal recycling of phosphorus
    - » potential as a coldwater fishery
    - » volume and flushing rate
    - » projected growth rate in the watershed (MDEP, 2006)

Davis Pond and Holbrook Pond receive runoff from land uses that contribute to nutrient-loading and turbidity.

A watershed is the geographic area where all water running off the land drains to a given stream, river,

Exhibit 3.5 – *Maine Standards for Classification of Lakes and Ponds*

Class	Designated Uses	Tropic State	Bacteria	Discharge of Pollutants
GPA	Drinking water after disinfection, recreation, fishing, industrial process and cooling water supply, hydroelectric power generation, navigation, habitat for aquatic life	Based on measures of chlorophyll "a" content, Secchi disk transparency, and total phosphorus content; must be stable or decreasing and subject only to natural fluctuations; must be free of algal blooms	Bacteria of human origin may not exceed a geometric mean of 29 ppm	No new direct discharge of pollutants is allowed, other than aquatic pesticide treatments, chemical water restoration treatments, or stormwater runoff

Source: *Maine Public Law, Standards for Classification of Fresh Surface Waters, 38 MRSA §465-A.*

lake, wetlands, or coastal water. Watershed planning and management comprise an approach to protecting water quality and quantity that focuses on an entire watershed. The main watersheds in the study area are Felts Brook, Eaton Brook, Kidder Brook, Meadow Brook, Mill Brook, Davis Pond, the Thoroughfare, and Holbrook Pond (exhibit 3.3). All of the watersheds are located in the Lower Penobscot sub-watershed.

Stormwater runoff in urban areas is one of the leading sources of water pollution in the United States. Impacts to surface waters result from the following:

- bridging, enclosing in culverts, and rechanneling
- new impervious area that increases contaminants or sediments carried in runoff
- development in stream corridors and reduction in buffers of streams and waterways that would impact the ability of the buffer to treat stormwater

The No-Build Alternative would not impact surface waters.

The build alternatives would impact four or five streams; streams would be impacted by bridging them and enclosing portions in culverts, or both, once or more than once. The bridges would span the streams and in-stream activity would be temporary and limited to the area of the bridge. The build alternatives would enclose portions of streams in culverts ranging from approximately 222 to 567 feet (exhibit 3.6).

During final design of Alternative 2B-2/the Preferred Alternative, the MaineDOT would further evaluate opportunities to shorten the width of road-stream crossings, preserve the natural stream bottoms in the road-stream crossings, and promote passage of aquatic organisms. Stream crossings would be designed in accordance with the MaineDOT's *Waterway and Wildlife Crossing Policy and Design Guide* (MaineDOT, 2008e), except in cases where the drainage is not a stream.

Impervious areas increase the quantity of stormwater runoff and the potential for non-point source pollution. Water from storms that is not absorbed into the ground is discharged into surface waters at higher rates. Higher discharge rates increase the likelihood of contaminants or sediments entering the stream systems and subsequently affecting water quality.

New road-stream crossings increase non-point source discharge during construction and, over the long term, may alter stream and floodplain hydrology. The likelihood that waterborne pollutants would enter surface waters is determined, in part, by the proximity of the new impervious area. Increasing impervious areas within 500 feet of a stream may increase peak flow rates of runoff into the stream leading to alteration of the stream morphology. It also reduces the area

Exhibit 3.6 – *Impacts to Streams*

Waterway	New Impervious Area (acres)	Unnamed Tributary to Felts Brook	Felts Brook	Unnamed Tributary to Felts Brook	Eaton Brook	Unnamed Tributary to Eaton Brook	Total (number of bridges & number of crossings/feet)
Length (feet)		8,100	33,500	5,800	37,000	19,200	
No-Build							
2B-2/the Preferred Alternative	38		2 bridges - 250 feet	1 bridge - 25 feet 2 10'X10' box culverts - 342 feet	1 bridge - 100 feet	1 bridge - 100 feet 1 culvert - 212 feet, 5-foot diameter	5 bridges - 475 feet 3 culverts - 554 feet
5A2B-2	46	1 bridge - 25 feet	1 bridge - 25 feet	1 bridge - 25 feet 2 10'X10' box culverts - 355 feet	1 bridge - 100 feet	1 bridge -100 feet 1 culvert - 212 feet, 5-foot diameter	5 bridges- 275 feet 3 culverts - 567 feet
5B2B-2	42		2 bridges - 250 feet	1 bridge - 25 feet	1 bridge - 100 feet	2 bridges - 325 feet 1 culvert - 222 feet, 5-foot diameter	6 bridges - 700 feet 1 culvert - 222 feet

Notes: *25 feet was added to both ends of the road-stream crossing.*
Bridges span waters with no in-stream activity.

available to attenuate materials that are washed off the roadway from a storm, which leads to sedimentation and contamination.

A short-term increase in the potential for sediment loading to surface waters exists. Impacts from sedimentation caused by construction would be temporary. During final design of Alternative 2B-2/the Preferred Alternative, the highway drainage system would be designed to minimize the transport of sediments and other particulates to surface waters. Buffers improve water quality by helping to filter pollutants in run-off both during and after construction. Erosion and sedimentation control measures would be incorporated into the design and implemented during construction in accordance with Section II of the MaineDOT's *Best Management Practices Manual for Erosion and Sedimentation Control* (MaineDOT, 2008a) and designed in accordance with the MDEP/MaineDOT/Maine Turnpike Authority Memorandum of Agreement, Stormwater Management, November 14, 2007 and Chapter 500 Rules.

During final design of Alternative 2B-2/the Preferred Alternative, the MaineDOT would further analyze opportunities to maintain and restore predevelopment (pre-construction) hydrology.

The MaineDOT would be required to meet the General Standards under Chapter 500 to the extent practicable as determined through consultation with and agreement by MDEP. Under the Chapter 500 General Standards for a linear project, MaineDOT would be required to treat 75% of the linear portion of Alternative 2B-2/the Preferred Alternative's impervious area and 50% of the developed area that is impervious or landscaped for water quality. To meet the General Standards, a project's stormwater management system must include treatment measures that would mitigate for the increased frequency and duration of channel erosive flows due to runoff from smaller storms, provide for effective treatment of pollutants in stormwater, and mitigate potential temperature impacts.

Additionally, the MaineDOT would consider green infrastructure and low-impact development practices such as reducing impervious surfaces, using vegetated swales and revegetation, protecting and restorating riparian corridors, and using porous pavements.

Groundwater. The entire study area is underlain by shallow sand and gravel aquifers and deeper bedrock aquifers. The sand and gravel aquifers in the glacial deposits are the primary groundwater sources for municipal, industrial, and domestic wells in Maine. The State of Maine defines sand and gravel deposits capable of yielding 10 or more gallons per minute (gpm) to a properly installed domestic well as "significant sand and gravel aquifers" that occur primarily in the valleys of major rivers and their tributaries (exhibit 3.3) (Nell, Steiger, and Weddle, 1992).

In the study area, significant sand and gravel aquifers are present in localized areas along the Penobscot River and near Route 46 (Foster and Smith, 2008). These sands are generally very permeable and, where saturated, can yield large quantities of water. Till and glacial marine deposits, which blanket the bedrock in most of the study area, generally do not have well-sorted deposits of sand and gravel and are considered poor aquifers.

Bedrock aquifers are the main source of groundwater in the study area. Groundwater movement is controlled by the distribution and characteristics of brittle fractures in the bedrock. The highest yields are found where the bedrock is extensively fractured. The bedrock aquifer is generally capable of supplying small to intermediate public and private needs (Loiselle, 2007).

Topography is a controlling influence on both depth to groundwater and direction of groundwater flow. The water table is generally shallower in valleys and deeper on hilltops. The presence of wetlands reflects the intersection of the water table with the ground surface. On average, the depth to the water table is expected to be less than 15 feet in the study area (Nell, Steiger, and Weddle, 1992; Maine Geological Survey, 2008). Localized groundwater-flow direction is quite variable due to the irregular topography. In general, the western two-thirds of the study area drains to the west to the Penobscot River, and the eastern one-third of the area drains to the east toward Holbrook Pond and Davis Pond.

Private wells in areas not currently served by the municipal or other public water systems were identified by the Maine Geological Survey (MGS). The database consists of private wells that have been installed since 1988, when mandatory reporting of new well installations began in accordance with provisions of the Maine Water Well Information Law (i.e., 12 MRSA § 550-B). The database consists of those wells identified through both voluntary reporting prior to 1988 and well surveys conducted in the 1970s.

The Private Water Well Database maintained by the MGS showed 134 wells in the study area. Well depths range from 40 to 495 feet, with most wells between 100 and 300 feet deep. Well yields are generally less than 10 gpm (Maine Geological Survey, 2008).

Smaller public water-supply well systems exist for commercial and residential establishments such as restaurants, inns, gasoline stations, and mobile-home parks. The State of Maine defines a public water system as "…any publicly or privately owned system of pipes, structures, and facilities through which water is obtained for or sold, furnished, or distributed to the public for human consumption." A public water system must have at least 15 service connections and regularly serve a minimum average of 25 people daily for a minimum of 60 days of the year or through the sales of bottled water (Maine Department of Human Services, Division of Health Engineering, 2001).

The Maine Drinking Water Program showed 33 public water-supply wells in the study area (exhibit 3.3). Most drinking water in Holden comes from private drilled wells (Maine Department of Human Services, 2004). Eddington is served by water lines from Bangor and Brewer (Hinkley, 2001).

Groundwater quality in the study area is generally good. Water from bedrock is often higher in chloride, nitrates, and hardness than water from glacial sediments. Elevated levels of iron and manganese may be present in some groundwater (Prescott, 1966).

No sole-source aquifers, as defined by the U.S. Environmental Protection Agency (USEPA), exist in the study area (USEPA, 2009).

Impacts to groundwater result from the following:

- increased number of impervious areas that reduce the ability of the ground to absorb water and replenish groundwater supplies
- introduction of contaminants into groundwater

The No-Build Alternative would not impact groundwater.

The build alternatives would not impact significant sand and gravel aquifers (i.e., aquifers yielding 10 gpm or more) or recorded public water-supply wells.

The build alternatives would result in an increase in impervious surfaces. This would increase runoff and reduce the area available to absorb runoff.

Precipitation and runoff from highways would be collected in the highway's drainage system, where it would enter the soil and contribute to groundwater recharge. Similar to surface waters, contaminants discharged with runoff from highways have the potential to infiltrate groundwater and impact groundwater quality. The highway drainage system would be designed in accordance with the MDEP/MaineDOT/Maine Turnpike Authority Memorandum of Agreement, Stormwater Management, November 14, 2007 ensuring that the impacts of highway-associated contaminants to groundwater are minimized.

3.1.2.2 Aquatic Habitats and Fisheries

Waterways. The Penobscot River watershed provides a migratory pathway, feeding area, spawning area, nursery area, and valuable habitat for a variety of fish species, some that that are harvested both commercially and recreationally.

According to the Maine Department of Inland Fisheries and Wildlife (MDIFW), the Lower Penobscot River serves as a migratory pathway, spawning area, nursery, and feeding area for a variety of diadromous fish species, including the Atlantic salmon, alewife, blueback herring, American shad, American eel, Atlantic sturgeon, shortnose sturgeon, striped bass, sea lamprey, rainbow smelt, and brook trout. Rainbow smelt and alewives are harvested commercially. The principal game fish species in the study area are lake trout, brook trout, brown trout, smallmouth bass, largemouth bass, white perch, yellow perch, pickerel, rainbow smelt, hornpout (i.e., brown bullhead), white sucker, pumpkinseed, and redbreast sunfish (Town of Holden, 2007).

The lower reaches of Felts Brook and Eaton Brook adjacent to the Penobscot River potentially maintain viable Atlantic salmon populations and, therefore, constitute high-value fisheries. The riparian corridors along Felts Brook and Eaton Brook are generally well established and provide abundant shade and woody debris to enhance fish habitat (Town of Holden, 2007). However, the riparian corridors along the central portions of these streams have been degraded by the removal of woody vegetation, particularly in association with agricultural activities.

The MDIFW classified Holbrook Pond and Davis Pond as having moderate fishery values. Holbrook Pond presents good opportunities for catching smallmouth bass. The principal fish species in Davis Pond include yellow perch, hornpout, American eel, white sucker, minnow, and sunfish. Both ponds have been invaded by non-native largemouth and smallmouth bass that may adversely affect the existing warmwater fisheries (Town of Holden, 2007).

On September 3, 2008, the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) published a proposed rule (73 *Federal Register* 51415) to list an expanded Gulf of Maine (GOM) Distinct Population Segments (DPS) of Atlantic salmon as endangered under the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531 et. seq.). On September 5, 2008, the NMFS published a proposed rule (73 *Federal Register* 51747) to designate critical habitat for this expanded GOM DPS of Atlantic salmon. In June 2009, the NMFS and the USFWS jointly published a final rule to list the expanded GOM DPS as an endangered species (74 Federal Register 29344). The GOM DPS was originally listed as an endangered species in 2000, but the geographic extent of that listing was considerably smaller than the current GOM DPS as an endangered species. (74 *Federal Register* 29344). The NMFS also designated critical habitat for the expanded DPS (74 *Federal Register* 29300).

The study area is in the range of the GOM DPS of Atlantic salmon in Maine, a federally endangered species under the joint jurisdiction of the USFWS and the NMFS. The Atlantic salmon GOM encompasses all naturally spawned and conservation hatchery populations of diadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine Coast to the Dennys River, an area that includes the Penobscot River, and wherever these fish occur in the estuarine and marine environment. The Penobscot River and its tributaries are included within the range of the GOM DPS. Also included in the GOM DPS are the associated conservation hatchery populations used to supplement these natural populations. The study area occurs within the Penobscot River watershed and that has been designated as critical habitat for Atlantic salmon by the NMFS. Critical habitat is designated to include all perennial rivers, streams, estuaries, and lakes connected to the marine environment within the designated watershed (USFWS, 2008).

Designating habitat as critical requires federal agencies to identify the habitats' Primary Constituents Elements (PCEs). For Atlantic salmon, the PCEs are (1) migration habitat, and (2) spawning and rearing habitat. For an adult to successfully migrate to freshwater for suitable spawning grounds, holding areas must be available en route. These allow for resting and provide refuge in the event that adverse conditions occur. Holding areas can include deep pools or deadwaters, lakes and ponds, and even the estuary. On occasion, an adult can reach the spawning ground weeks or even months in advance of spawning. These early arrivers require holding areas in proximity to spawning areas that provide shade; cover from predators; and protection from environmental variables such as high flows, high temperatures, and sedimentation. Optimal spawning habitat is gravel substrate with adequate water circulation to keep buried eggs well oxygenated. As such, spawning sites (i.e., redds) are typically positioned within flowing water to allow for percolation through the gravel or where upwellings of groundwater occur. A redd that is constructed in waters that are too shallow are at risk of desiccation or freezing, whereas one that is too deep may not have enough flow for adequate permeation of oxygenated water through the substrate to the eggs. Additionally, water velocities that are too low can result in accumulation of fine sediments in the redd and prevent the proper cleaning of eggs; flows that are too high can result in excessive scouring and cause redd excavation. Also, spawning adults require adequate space. A typical redd encompasses slightly more than 40 square feet of spawning habitat (NOAA Fisheries Service, 2010).

Alewife and blueback herring are fish that spend the majority of their life at sea but return to freshwater to spawn and are native to Maine rivers. However, alewife's and blueback herring's population has declined; dams, pollution and overfishing have taken their toll. On November 2, 2011, these fishes were listed as candidate species under the ESA until further review was conducted (NOAA, 2012).

The American eel has a catadromous life cycle, that is, it spawns in the ocean and migrates to fresh water to grow to adult size. As adult eels mature, they leave the brackish/freshwater growing areas in the fall (August to November), migrate to the Sargasso Sea and spawn during the late winter. After spawning, the adult eels die.

Impacts from road-stream crossings are loss of stream flow complexities (e.g., riffles and pools), loss of natural stream substrate, shading and lowering of temperature, removal of riparian vegetation and opening up the stream channel to additional sun-light if the forest canopy is removed, reduction of water quality from highway runoff, alteration of stream hydrology, reduction in mobility of aquatic biota through loss or alteration of habitat, and loss of stream-bank complexity. These impacts result in the loss of aquatic habitat and a decline in the quality of habitat for fish and other aquatic life. These impacts are limited to the area of the individual road-stream crossings and channelization (sections 3.1.2.4 and 3.1.4.4) However, a road-stream crossing that is not "well" designed for aquatic habitat can have impacts on habitat both upstream and downstream of the crossing footprint.

The No-Build Alternative would not impact aquatic habitats or fisheries.

The build alternatives would impact aquatic habitats and fisheries through the road-stream crossing and channelization of streams (exhibit 3.6). Because road-stream crossings with natural bottoms would be used, small amounts of stream channel bottom habitat may be impacted during construction.

Road-stream crossings can create restrictions or localized changes in flows so that animal movement could be inhibited. The MaineDOT's *Waterway Crossing Policy and Design Guide* is intended to reduce the likelihood that road-stream crossings would create a barrier to the movement of aquatic organisms. The MaineDOT would further evaluate opportunities to shorten the length of road-stream crossings and preserve the natural stream bottoms. Road-stream crossings would be designed in accordance with the MaineDOT Waterway and Wildlife Crossing Policy and Design Guide (MaineDOT, 2008e), except in cases where the drainage is not a stream. Stream crossings would be evaluated for aquatic-organism passage and impacts would be mitigated by providing passage. Stream-bank impacts would be minimized by revegetation.

During final design, the MaineDOT would analyze opportunities to further minimize impacts to aquatic habitat and fisheries.

Magnuson–Stevens Fishery Conservation and Management Act and Sustainable Fisheries Act of 1996. The 1996 amendments to the Magnuson–Stevens Fishery Conservation and Management Act (Magnuson–Stevens Act) require that essential fish habitat (EFH) consultation be conducted for any activity that may adversely affect important habitats of federally managed marine and anadromous fish species. Under Section 303(a) (7) of the Magnuson–Stevens Act, as amended, EFH must be properly described and identified for those species considered under Federal Fishery Management Plans. According to 16 USC 1802(10), EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." "Waters" refers to the physical, chemical, and biological properties of aquatic areas currently or historically used by fish. "Substrate" refers to sediment, hard bottom, or other underwater structures and their biological communities. The term "necessary" indicates that the habitat is required to sustain the fishery and support the fish species' contribution to a healthy ecosystem. These regulatory requirements are intended (to the extent practicable) to minimize adverse impacts on habitat caused by fishing or other non-fishing activities, and to identify other actions to encourage the conservation and enhancement of EFH. EFH can be designated for four life stages: eggs, larvae, juveniles, and adults. The following information is provided to meet the EFH assessment requirement.

When the NMFS receives information regarding a federal action that may adversely affect EFH, that agency must conduct an EFH assessment. The assessment is a review of the proposed project and its potential impacts to EFH. As set forth in the rules, EFH assessments must include the following:

- a description of the proposed action
- an analysis of the impacts, including cumulative impacts of the action on EFH, the managed species, and associated species by life-history stage
- the federal agency's views regarding impacts of the action on EFH
- proposed mitigation, if applicable

Description of the Proposed Action. The MaineDOT and the FHWA are preparing a DEIS/Section 404 Permit application that considers four alternatives, including the No-Build Alternative, to improve the transportation-system linkage, safety, and mobility between I-395 and Route 9 in southern Penobscot County, Maine (Chapter 1). The need (i.e., the problem) for transportation improvements is based on poor roadway geometry in the study area combined with an increase in local and regional commercial and passenger traffic that has resulted in poor system linkage, safety concerns, and traffic congestion.

The alternatives retained for further consideration are (Chapter 2) as follows:

- No-Build Alternative
- Alternative 2B-2/the Preferred Alternative
- Alternative 5A2B-2
- Alternative 5B2B-2

Essential Fish Habitat. In "Report to Congress: Status of the Fisheries of the United States (September 1997)", the NMFS determined that Atlantic salmon is considered overfished, based on an assessment of stock level. EFH for Atlantic salmon is described as all waters currently or historically accessible to Atlantic salmon within the streams, rivers, lakes, ponds, wetlands, and other water bodies of Maine (NOAA, 2009a). In the study area, the Penobscot River and Eaton and Felts Brooks are EFH for Atlantic salmon (NOAA, 2009b; New England Fishery Management Council (NEFMC), 2006).

The Penobscot River has been designated as habitat areas of particular concern (HAPC) for Atlantic salmon. HAPCs are described as subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Designated HAPCs are not afforded any additional regulatory protection under the Act; however, federal projects with potential adverse impacts to HAPCs will be more carefully scrutinized during the consultation process.

Analysis of the Impacts of the Action on EFH, the Managed Species, and Associated Species by Life

Exhibit 3.7 – *Managed Species by Life-History Stage*

Stage	Atlantic Salmon
Eggs	F/gravel or cobble riffles/below 10° C (50 F)/shallow
Larvae	F/gravel or cobbles/below 10° C (50 F)/shallow
Juveniles	F/shallow gravel and cobbles/below 10° C (50 F)/4 to 20 inches
Adults	F,M,S/ pelagic/oceanic when not returning to spawn
Spawning Adults	F/gravel or cobbles riffles/below 10 ° C (50 F)/12 to 20 inches (October and November)

Legend: *salinity code/substrate type/water temperature/water depth*
S = seawater salinity zone (salinity > 25.0%)
M = mixing water/brackish salinity zone (0.5 < salinity < 25.0%)
F = freshwater salinity zone (0.0 < salinity < 0.5%)

History Stage. The No-Build Alternative would not impact EFH.

The build alternatives may affect EFH through the road-stream crossing and channelization of streams (exhibit 3.7).

The road-stream crossings may affect Atlantic salmon during their eggs and larvae stages (exhibit 3.6). Construction of the road-stream crossings increases sediments that could affect migrating adult salmon.

There would be temporary impacts from construction of a build alternative and occur during and following construction. The time for individual or specific construction impacts to dissipate varies with the type of activity performed and resource impacted; most construction impacts cease immediately after the activity in an area is completed. Other impacts on aquatic resources, such as those from a bridge with considerable in-stream activity, could take years to recover to preconstruction conditions.

The USFWS and NMFS's Views regarding Impacts of the Action on EFH. This DEIS provides information on the potential impacts from the proposed action on EFH. The federal agency's views on the potential impacts from the proposed action on EFH would be incorporated into the FEIS.

Proposed Mitigation. Ideally, to pass fish effectively and minimize impacts to EFHs, crossings must satisfy the following criteria:

1. Design Peak Flow: This represents the optimal design that minimizes the expected cost associated with flooding.
2. Maximum Velocity: Determining approximate maximum water velocities for assessing whether the target fish population could swim upstream against the current at critical periods.
3. Minimum Depth: Providing minimum depth ensures adequate water depth during periods of simultaneous low flow and fish movement. New and replacement pipes should be sized for consistency with the natural channel bank full width and depth, with the implicit assumption

that such sizing would produce automatically the desired flow velocities and depths.

4. Gradient: Culverts should be installed at the proper elevation to avoid perched outlets that fish cannot access. Pipes should be embedded and allowed to fill in to maintain a continuous, natural gradient.

Other practices that could minimize impacts to EFHs are installing new structures with inverts below streambed elevation; installing structures with no bottoms (e.g. bottomless arch culverts or three-sided boxes or bridges); allowing existing streambed characteristics to be maintained naturally to the extent practicable and required to maintain passage for identified species; not exceeding the existing natural gradient taken over stream segments upstream and downstream of the crossings; and calculating flow depths during species-specific periods of movement for the pipe design at appropriate-specific passage design flows.

Mitigation for potential impacts from the build alternatives would be to limit alterations in flow characteristics caused by road-stream crossings and to limit noise and vibration impacts during construction. Stream crossings would be designed in accordance with the MaineDOT's *Waterway and Wildlife Crossing Policy and Design Guide* (MaineDOT, 2008e). During final design, the MaineDOT would analyze opportunities to further minimize impacts to EFH by considering minor shifts in the alignment of Alternative 2B-2/the Preferred Alternative and increasing the slope of fill material reducing culvert length.

Vernal Pools. According to the MDEP, vernal pools or "spring pools" are shallow depressions that usually contain water for only part of the year. It is a natural, temporary, or semipermanent body of water occurring in a shallow depression that typically fills during the spring or fall and may be dry during the summer. Vernal pools are defined as temporary pools that serve as reproductive habitat for amphibians such as spotted salamanders, blue-spotted salamanders, and wood frogs. Those species breed primarily in vernal pools because the temporary nature of the pools supports invertebrate food sources and discourages colonization of predatory fish.

The NRPA's definition of a vernal pool, also referred to as a seasonal forest pool, is a temporary to semipermanent body of water occurring in a shallow depression that typically fills during the spring or fall and may be dry during the summer. Vernal pools have no permanent inlet or outlet and no viable populations of predatory fish. A vernal pool may provide the primary breeding habitat for wood frogs, spotted salamanders, blue-spotted salamanders, and fairy shrimp, and valuable habitat for other plants and wildlife including rare, threatened, and endangered species. The presence of fairy shrimp, blue-spotted salamanders, spotted salamanders, or wood frogs (in any life stage and abundance) would designate the water body as a vernal pool (USACE, 2010a). The USACE does not rate or rank vernal pools similar to Maine's regulation of only significant vernal pools; the USACE considers information on vernal pools, including those determined to be significant by the State of Maine.

Spotted salamanders and blue-spotted salamanders migrate to and from vernal pools in early spring on warm rainy nights when the air temperature is 50 degrees F or more and it rains at least 0.15 inch over a 24-hour period (Rorer et al., 1983). They spend approximately one month or so breeding in vernal pools before dispersing to terrestrial habitat, which is usually moist upland woods. They hide under rotting logs or in the leaf litter until they make their way into burrows. These are usually small-mammal burrows where the salamanders overwinter below the frost line.

Wood frogs spend approximately one month in the vernal pools and disperse to primarily forested wetlands, although they are known to use other wetlands types. The frogs feed and forage in the wetlands and overwinter by freezing solid in the leaf litter.

Vernal-pool species usually migrate no more than tens to hundreds of feet from vernal pools, known as their dispersal habitat. This means that landscape changes surrounding vernal pools can have direct impacts on a large fraction of an amphibian population and the incremental destruction of vernal pools and the surrounding forest habitat increases pond isolation, potentially impairing connectivity among populations. Loss of connectivity can be harmful for vernal-pool species. Long-term data suggest that vernal-pool species are less likely to be present, and less likely to persist when the nearest sources of colonies are farther away. This implies that long-term persistence of vernal-pool species within a pool depends on successful dispersal of individuals from other pools (Calhoun and deMaynadier, 2008).

According to the MDEP, a vernal-pool habitat is considered significant wildlife habitat if it has high habitat value. "Significant vernal pools" are a subset of vernal pools with particularly valuable habitat. The State of Maine deems that a vernal pool is significant if it meets one of the following criteria. The criteria are:

- It supports a state-listed threatened or endangered species
- It supports abundant egg masses of any one of the following amphibian indicator species: spotted salamanders, blue-spotted salamanders, or wood frogs. (Egg-mass numbers vary with species and were based on extensive

surveys of pools throughout Maine.) the abundance criteria on vernal pools being significant is 10 or more egg masses of the blue-spotted salamander, 20 or more egg masses of the spotted salamander, 40 or more egg masses of the wood frog. Egg mass counts are a surrogate of indication of productivity.

- It supports fairy shrimp.

Starting on September 1, 2007, significant vernal pool habitat is protected by law under the NRPA. Development within 250 feet of a significant vernal-pool requires a MDEP permit (MDEP, 2008).

In the study area, three vernal-pool indicator species (spotted salamander, blue-spotted salamander, and wood frog) and 12 herptile species were identified (exhibit 3.8). The MDEP and/or the MDIFW believe that less than half of all Maine vernal pools are considered "significant." There were 251 vernal pools identified: 55 significant and 196 that do not meet the significant criteria (exhibit 3.3). Green frogs were the most commonly encountered species in the study area. Wood-frog adults and larvae and spotted-salamander egg masses were locally abundant in some of the vernal pools.

Vernal-pool species need vernal pools to breed (although they do occasionally breed in other aquatic habitats) but they spend much of their lives in other habitats and need safe passage to those areas. Roads would present a barrier for these species unless safe passage is available. Research indicates that winter maintenance salts would impact amphibian development in vernal pools (Karraker, 2006; 2011).

Potential impacts to vernal pools result from:

- filling of pools
- filling or alteration of dispersal habitat

Exhibit 3.8 – *Vernal Pools and Herptiles in Vernal Pools in the Study Area*

Common Name	Observed in a Vernal Pool[1] (Yes/No)	Number of Vernal Pools that Exceeds Abundance Criteria[2]
Spotted Salamander[3]	Yes	37
Blue-Spotted Salamander[3]	Yes	1
Eastern Red-Spotted Newt	Yes	
Wood Frog[3]	Yes	16
Green Frog	Yes	
Bull Frog	Yes	
Mink Frog	Yes	
Spring Peeper	Yes	
Gray Tree Frog	Yes	
American Toad	Yes	
Eastern Painted Turtle	Yes	
Eastern Garter Snake	No	
Ribbon Snake	No	

Note:
[1] *Observations could be of adult, larvae, eggs, or vocalization.*
[2] *Some vernal pools have more than one indicator species that exceeds the state's significance criteria.*
[3] *Indicator species.*

Exhibit 3.9 – *Impacts to Vernal Pools*

Alternative	Number of Vernal Pools	Significant		Dispersal Habitat within 250 feet (ac.)	Dispersal Habitat within 750 feet (ac.)	Total
		Yes	No			
No-Build				54	480	
2B-2/the Preferred Alternative	1		x	17	278	1
5A2B-2	1		x	25	395	1
5B2B-2	1		x	8	146	1

- creating a barrier to animal dispersal by roadway placement
- anti-icing and de-icing practices
- winter sand and sediment from runoff degrading habitat

The No-Build Alternative would not impact vernal pools.

The build alternatives would impact/fill one non-significant vernal pool (the same vernal pool for all three build alternatives) and its upland dispersal habitat (exhibit 3.9). The build alternatives may impact upland dispersal habitat from vernal pools not within the alignments of a build alternative.

The perimeter of vernal pools in and adjacent to Alternative 2B-2/the Preferred Alternative would be reevaluated and identified by the MaineDOT during final design. During final design of Alternative 2B-2/the Preferred Alternative, the MaineDOT would work to further avoid and minimize impacts to dispersal habitat for vernal pools by considering minor shifts in the alignment of Alternative 2B-2/the Preferred Alternative and increasing the slope of fill material.

3.1.2.3 Floodplains

Federal protection of floodplains is afforded by Executive Order 11988, "Floodplain Management," and implemented under 44 CFR 9.00. These regulations direct federal agencies to undertake actions to avoid impacts on floodplain areas by structures built in flood-prone areas. In accordance with these federal directives, the FHWA also enacted federal-aid policy guidance and regulations under 23 CFR 650. The Federal Emergency Management Agency (FEMA) has primary responsibility for identifying flood-prone areas.

The study area contains land that could be inundated by a flood of a magnitude that has a one percent chance of being equaled or exceeded in any given year (i.e., 100-year floodplain).

Approximately 3,322 acres (9.7 percent) of the study area is identified as an area located within the 100-year floodplain (exhibit 3.10). The Eaton Brook watershed has the most floodplains, and the Davis Pond watershed has the largest percentage of floodplains in its landmass area.

Land within the 100-year floodplain is primarily forested and is located adjacent to the Penobscot River, Felts Brook, Eaton Brook, Cummings Bog, Holbrook Pond, and Davis Pond in the study area (exhibit 3.3) (FEMA, 1997).

In the State of Maine, wetlands in the 100-year floodplain are included in definitions of and protections provided for wetlands of special significance under the NRPA and the wetlands rules found in 38 MRSA §480 et. seq.

In accordance with Executive Order 11988, Floodplain Management, impacts on floodplains and floodplain encroachments were considered for the No-Build Alternative and the build alternatives. Encroachments are considered significant under Executive Order 11988 if at least one of the following factors is applicable:

- It has a significant effect on natural and/or beneficial floodplain values.
- It would increase the risk of flooding that could result in the loss of life or property.

Exhibit 3.10 – *Floodplains*

Watersheds	*Acres of Floodplains*	*Percent of Floodplains in Watersheds*
Felts Brook	140	2.8
Eaton Brook	1,327	11.8
Kidder Brook	27	4.6
Meadow Brook	133	6.0
Mill Brook	7	0.4
Davis Pond	611	22.1
Thoroughfare	149	4.5
Holbrook Pond	493	15.2
Other	435	6.7
Study Area	3,322	9.7

- It would significantly impact or otherwise disrupt vital services, facilities, or travel routes.

Impacts to floodplains result from:

- reduction of flood storage from filling
- increase in tailwater elevations at road-stream crossings

The No-Build Alternative would not impact floodplains.

The build alternatives would not impact floodplains in the Kidder Brook, Meadow Brook, Mill Brook, the Thoroughfare, Davis Pond, or Holbrook Pond watersheds. The build alternatives would impact two to 11 acres of floodplains with most of the impacts occurring in the Felts Brook watershed (exhibit 3.11).

Floodplains have been avoided to the extent possible. Where impacts could not be avoided, the build alternatives were designed to cross floodplains in remote areas and at the narrowest location practical while avoiding and minimizing impacts to other features. Enclosures have been conceptually designed and placed to minimize impacts to floodplains.

During final design, the MaineDOT would work to further avoid and minimize impacts to floodplains by considering minor shifts in the alignment of Alternative 2B-2/the Preferred Alternative and increasing the slope of fill material that could reduce the amount of fill material placed in floodplains. The road-stream crossings were conceptually designed; detailed hydraulic analysis to size the road-stream crossings would be performed during final design. If during final design, it is determined that there would be lost storage volumes, it would be mitigated.

Exhibit 3.11 – *Impacts to Floodplains by Watershed (acres/percentage)*

Alternative	Watersheds		
	Felts Brook	Eaton Brook	Total
No-Build	–	–	–
2B-2/the Preferred Alternative	8	2	10 (0.3%)
5A2B-2	–	2	2 (0.0%[1])
5B2B-2	8	3	11 (0.3%)

[1]Impact to floodplains less than one tenth of one percent.

3.1.2.4 Wetlands

Wetlands are those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (USACE, 1987).

Wetlands were identified using a combination of mapping from the National Wetlands Inventory (NWI), hydric soils determined by the USDA, the NRCS, and a field reconnaissance of portions of the study area. The NWI is a program administered by the USFWS for mapping and classifying wetlands resources in the United States.

Hydric soils are soils that are saturated, flooded, or ponded long enough during the growing season to develop at least temporary conditions in which there is no free oxygen in the soil around roots. Generally, hydric soils correspond closely to wetlands (USDA, 1995). For the purposes of this study, hydric soils were assumed to be wetlands; some hydric soils, however, would not be wetlands based on a field delineation and totals used in this EIS/Section 404 Permit Application Supporting Information may slightly over estimate the amount of wetlands in the study area.

Following the identification of wetlands from the NWI and hydric soils information, the MaineDOT performed a reconnaissance of the corridors of the alternatives retained for further consideration. The purpose of the reconnaissance was to confirm the accuracy of the information from the NWI and information detailing the locations of hydric soils. The MaineDOT will delineate wetlands for Alternative 2B-2/the Preferred Alternative during the final design phase; the delineation of the LEDPA would be done to meet the USACE's requirements.

Approximately 10,962 acres (31.9 percent) of the study area is wetlands (exhibits 3.3 and 3.12). Large wetlands complexes are located along the Thoroughfare between Davis Pond and Holbrook Pond, at Cummings Bog south of Route 9, and along the Felts Brook and Eaton Brook stream corridors.

Palustrine wetlands exist throughout the study area. The term *palustrine* refers to a system of wetlands which consists of "all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent"(Mitsch and Gosselink, 2007). Historic or traditional names for palustrine wetlands include marsh, swamp, bog, fen, and prairie, as well as other water bodies such as ponds (USFWS, 1979). These wetlands are distributed fairly evenly throughout the study area; however, they are most prevalent near Holbrook Pond, Davis Pond, and Cummings Bog.

Wetlands Protection and Definitions

Federal

Executive Order 11990, "Protection of Wetlands," requires federal agencies to avoid, to the extent practicable, long- and short-term impacts associated with the destruction or modification of wetlands. More specifically, it directs federal agencies to avoid new construction in wetlands unless there is no practical alternative. It further states that where wetlands cannot be avoided, the proposed action must include all practical measures to minimize harm to the wetlands.

Section 404 of the U.S. CWA provides protections for waters of the United States and wetlands, including special aquatic sites. The definition of special aquatic sites including mudflats, which are vegetated shallows harboring areas of permanently inundated, rooted aquatic vegetation such as eelgrass. Work in or affecting navigable waters is regulated under Section 10 of the U.S. Rivers and Harbors Act of 1899.

State

The MDEP regulates activities in wetlands under the NRPA (38 MSRA §§ 480-A through 480-BB). This act provides protection for resources that are defined to include coastal dune systems; coastal wetlands; significant wildlife habitat; freshwater wetlands; great ponds; and rivers, streams, and brooks. These requirements are implemented through a state regulatory framework that includes the Chapter 310 Wetlands Protection rules as codified in Maine regulations (06-096 CMR 310). Activities that have a greater potential to affect certain protected resources – including coastal wetlands under the NRPA and other "freshwater wetlands of special significance," as defined under Chapter 310 of the wetlands rules – are generally subject to more extensive and restrictive permitting requirements. For these activities, the hierarchical analysis of avoidance, minimum alteration, compensation, and no unreasonable impact would apply.

Exhibit 3.12 – *Wetlands by Watershed*

Watersheds	Wetlands	Acres of Wetlands	Percentage Wetlands in Watershed	Percentage Wetlands in Study Area
Study Area				
Palustrine	Emergent, Persistent Wetlands	770		7.0%
	Forested Wetlands	7,693		70.1%
	Scrub-Shrub	1,172		10.6%
	Unconsolidated Bottom	172		1.5%
Lacustrine		924		8.4%
Riverine		231		2.1%
Total		***10,962***		***100%***
Felts Brook				
Palustrine	Emergent, Persistent Wetlands	141	9.3%	1.3%
	Forested Wetlands	1,119	73.8%	10.2%
	Scrub-Shrub	234	15.4%	2.1%
	Unconsolidated Bottom	23	1.5%	0.2%
Lacustrine		-	-	-
Riverine		-	-	-
Total		***1,517***	***100%***	***13.8%***
Eaton Brook				
Palustrine	Emergent, Persistent Wetlands	269	7.8%	2.5%
	Forested Wetlands	2,647	76.8%	24.1%
	Scrub-Shrub	439	12.7%	4.0%
	Unconsolidated Bottom	90	2.6%	0.8%
Lacustrine		-	-	-
Riverine		1	-	0.0%[1]
Total		***3,445***	***100%***	***31.4%***

[1]*Less than one tenth of one percent.*

Watersheds	Wetlands	Acres of Wetlands	Percentage Wetlands in Watershed	Percentage Wetlands in Study Area
Kidder Brook				
Palustrine	Emergent, Persistent Wetlands	1	0.6%	0.0%[1]
	Forested Wetlands	119	94.9%	1.1%
	Scrub-Shrub	1	1.1%	0.0%[1]
	Unconsolidated Bottom	–	–	–
Lacustrine		4	3.4%	0.0%[1]
Riverine		-	-	-
Total		***125***	***100%***	***1.1%***
Meadow Brook				
Palustrine	Emergent, Persistent Wetlands	26	3.5%	0.2%
	Forested Wetlands	629	86.0%	5.7%
	Scrub-Shrub	67	9.1%	0.6%
	Unconsolidated Bottom	10	1.4%	0.1%
Lacustrine		-	-	-
Riverine		-	-	-
Total		***732***	***100%***	***6.6%***
Mill Brook				
Palustrine	Emergent, Persistent Wetlands	49	9.5%	0.4%
	Forested Wetlands	438	84.1%	4.0%
	Scrub-Shrub	25	4.8%	0.2%
	Unconsolidated Bottom	6	1.2%	0.1%
Lacustrine		2	0.4%	0.0%[1]
Riverine		-	-	-
Total		***520***	***100%***	***4.7%***

[1]*Less than one tenth of one percent.*

Exhibit 3.12 – *Wetlands by Watershed (continued)*

Watersheds	Wetlands	Acres of Wetlands	Percentage Wetlands in Watershed	Percentage Wetlands in Study Area
Davis Pond				
Palustrine	Emergent, Persistent Wetlands	71	5.8%	0.6%
	Forested Wetlands	536	43.3%	4.9%
	Scrub-Shrub	168	13.6%	1.5%
	Unconsolidated Bottom	7	0.6%	0.0%[1]
Lacustrine		454	36.7%	4.1%
Riverine		-	-	-
Total		***1,236***	***100%***	***11.1%***
Thoroughfare				
Palustrine	Emergent, Persistent Wetlands	84	23.0%	0.8%
	Forested Wetlands	201	55.2%	1.8%
	Scrub-Shrub	16	4.4%	0.1%
	Unconsolidated Bottom	1	0.3%	0.0%[1]
Lacustrine		62	17.1%	0.6%
Riverine		-	-	-
Total		***364***	***100%***	***3.3%***
Holbrook Pond				
Palustrine	Emergent, Persistent Wetlands	45	3.7%	0.4%
	Forested Wetlands	679	56.2%	6.2%
	Scrub-Shrub	83	6.8%	0.8%
	Unconsolidated Bottom	8	0.6%	0.1%
Lacustrine		395	32.7%	3.6%
Riverine		-	-	-
Total		***1,210***	***100%***	***11.1%***

[1]Less than one tenth of one percent.

Watersheds	Wetlands	Acres of Wetlands	Percentage Wetlands in Watershed	Percentage Wetlands in Study Area
Chemo Pond				
Palustrine	Emergent, Persistent Wetlands	22	4.3%	0.2%
	Forested Wetlands	463	91.0%	4.2%
	Scrub-Shrub	22	4.3%	0.2%
	Unconsolidated Bottom	2	0.4%	0.0%[1]
Lacustrine		-		
Riverine		-		
Total		***509***	***100%***	***4.6%***
Other				
Palustrine	Emergent, Persistent Wetlands	62	-	0.6%
	Forested Wetlands	862	-	7.9%
	Scrub-Shrub	117	-	1.1%
	Unconsolidated Bottom	25	-	0.2%
Lacustrine		7	-	0.1%
Riverine		230	-	2.1%
Total		***1,303***	***-***	***12.0%***
TOTAL in Above Watersheds		***10,962***		***100%***

[1]Less than one tenth of one percent.

Approximately 9,807 acres (28.5 percent) of the study area is classified as palustrine wetlands.

Lacustrine wetlands are found in the study area. A lacustrine system consists of wetlands and deep-water habitats with all of the following characteristics (USFWS, 1979):

- The wetlands are situated in a topographic depression or a dammed river channel.
- The wetlands are lacking trees, shrubs, persistent emergents, or emergent mosses or lichens with more than 30 percent area coverage.
- The wetlands total area exceeds 20 acres.

The lacustrine system consists of permanently flooded lakes and reservoirs and intermittent lakes (USFWS, 1979). Examples of these wetlands are Holbrook Pond and Davis Pond. Approximately 924 acres (2.7 percent) of the study area is classified as lacustrine wetlands.

Riverine wetlands include "all wetlands and deep water habitats contained within a channel with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens; and (2) deep water habitats with water containing ocean-derived salts in excess of 0.5 parts per thousand (ppt)" (Mitsch and Gosselink, 2007). Upland islands or palustrine wetlands may occur in the channel, but they are not part of the riverine system (USFWS, 1979). These wetlands are most prevalent along Felts Brook and Eaton Brook and along the Penobscot River in the study area. Approximately 230 acres (0.7 percent) of the study area is classified as riverine wetlands.

Generalized wetlands function and value evaluations were completed for four major wetlands complexes in the study area: Felts Brook, Eaton Brook, Cummings Bog, and the Thoroughfare between Davis Pond and Holbrook Pond. These wetlands areas were selected as representative of the major types of wetlands found in the study area. The evaluation was intended to provide an overall generalized assessment of the function and value of large wetlands complexes in the study area. No wetlands delineations in accordance with the USACE *Wetlands Delineation Manual* (USACE, 1987) were completed. Evaluations were based on an office review of existing data and a limited field assessment of wetlands areas. Evaluations were also based on guidance from the USACE *Highway Methodology Workbook Supplement* (USACE, 1995) and *Northcentral and Northeast Supplement* (USACE, 2009). There are no unique or unusual wetlands in the study area.

The MaineDOT will delineate wetlands and conduct a field assessment of functions and values of the specific wetlands that would be impacted for the selected alternative during the final design phase.

Wetlands functions relate to self-sustaining properties of wetlands that contribute to its continued existence. Functions such as primary production and nutrient-cycling are processes necessary for self-maintenance of the wetlands ecosystem. Therefore, functions relate to the ecological significance of wetlands regardless of their subjective human values.

Wetlands values are benefits to society that derive from either one or more ecological function and the physical characteristics associated with a wetlands (USACE, 1995). The value of a particular wetlands function is based on qualitative, educated judgment of the worth, merit, quality, or importance attributed to those functions.

Wetlands associated with Felts Brook are generally palustrine forested. The general function and values attributable to wetlands in the Felts Brook complex are flood-flow alteration, sediment retention, shoreline stabilization, and fish and wildlife habitat. These wetlands are located primarily along the floodplain of Felts Brook and provide a variety of habitats for aquatic and terrestrial wildlife.

The wetlands in the Eaton Brook complex are generally palustrine forested and scrub-shrub wetlands in the floodplain. These wetlands generally provide for floodplain alteration, sediment retention, shoreline stabilization, and fish and wildlife habitat. In addition, wetlands that are associated with Eaton Brook and Felts Brook perform a ground-water discharge function that adds to the base flow and may keep the stream temperatures down.

The wetlands associated with Cummings Bog are predominantly palustrine forested and palustrine scrub-shrub wetlands. These wetlands generally support flood-flow alteration, sediment retention, shoreline stabilization, and wildlife habitat. Additionally, this complex provides aesthetic value because of its variety of habitat, wildlife support, and location in a largely undeveloped area.

Palustrine-forested wetlands and areas of open water dominate the wetlands complex between Davis Pond and Holbrook Pond. These wetlands generally offer habitat to support fish and bird populations. These wetlands offer some aesthetic qualities in combination with the adjacent lake or pond areas that are used for recreational purposes.

Wetlands are not only highly productive, they are also rich in wildlife species. The association of some species with wetlands is very strong. These species can include the black bear, bobcat, common gray, Eastern red bat, ermine, fisher, Hoary bat, Little brown myotis, Long-tailed weasel, Masked shrew, Meadow vole, mink, moose, muskrat, Northern short-tailed shrew, raccoon, Silver-haired bat, Smoky shrew, Southern bog lemming, Star-nosed mole, Virginia opossum, Water shrew, and woodchuck. Birds in the study area consist of the American redstart, Baltimore oriole, Bank swallow, Barred owl, Blue-winged teal, Brown creeper, Canada goose, Canada warbler, Chipping sparrow, Common grackle, Common yellowthroat, Cooper's hawk, Dark-eyed junco, Eastern kingbird, Great-crested flycatcher, Great-horned owl, Hermit thrush, House wren, Long-eared owl, Nashville warbler, Northern parula, Northern rough-winged swallow, Northern waterthrush, Olive-sided flycatcher, Red-shouldered hawk, Red-tailed hawk, Rose-brested grosbeak, Ruffed grouse, Song sparrow, Tree swallow, Tufted titmouse, Turkey vulture, Veery, Virginia rail, Warbling vireo, and the Yellow rail.

Most wetlands mammals are herbivores or omnivores (i.e., they consume wetlands plants directly or have a mixed animal–plant diet). Wildlife is attracted to wetlands because they provide food, water, cover, and nesting sites, and they provide habitat for feeding, raising young, and traveling. Many species live their entire lives in wetlands and are completely dependent on them for survival (Maine Audubon Society, 2006; NRCS, 2001).

Approximately 40 percent of vernal pools were found in wetlands (section 3.1.2.2).

In accordance with Executive Order 11990, Protection of Wetlands, agencies shall avoid undertaking or providing assistance for new construction in wetlands unless:

- there is no practicable alternative to such construction
- the proposed action includes all practicable measures to minimize harm to wetlands that may result from its use

Impacts to wetlands result from:

- direct filling of a habitat
- impacts to functions and values
- indirect impacts to wetlands by siltation or hydrologic alterations
- conversion of one habitat to another

The No-Build Alternative would not impact wetlands.

The build alternatives would impact 26 to 31 acres (0.2 to 0.3 percent) of wetlands (exhibit 3.3 and exhibit 3.13). The approximately 15 to 18 wetlands impacted range from small isolated areas to large, expansive areas comprising hundreds of acres; these wetlands are in the Felts Brook, Eaton Brook, and Meadow Brook watersheds.

Wetlands have been avoided to the extent possible while avoiding and minimizing impacts to other features. To minimize impacts where further avoidance was not possible, fill material was designed with 1:1

side slopes (2:1 slopes were used when not in proximity to wetlands), the MaineDOT would reduce the right-of-way clearing to the minimum necessary and minimize clear zones at wetlands and streams. Wetlands would be delineated and a detailed assessment of the functions provided by these wetlands would be performed during final design of Alternative 2B-2/the Preferred Alternative. During final design, the MaineDOT would work to further minimize impacts to wetlands by considering minor shifts in the alignment of Alternative 2B-2/the Preferred Alternative and increasing the slope of fill material that could reduce the amount of fill material placed in wetlands. During final design of Alternative 2B-2/the Preferred Alternative, the MaineDOT would continue to coordinate with the federal and state regulatory and resource agencies.

The MaineDOT submitted an individual Section 404 Permit Application to the USACE for the discharge of fill material into waters of the United States (Appendix E). The MaineDOT would prepare and submit an NRPA Permit application to the MDEP during final design of Alternative 2B-2/the Preferred Alternative. The MaineDOT would coordinate the identification and development of compensatory mitigation with federal and state regulatory and resource agencies (see section 3.8).

Exhibit 3.13 – *Impacts to Wetlands by Watershed (acres/percentage)*

Alternative	Wetlands Types				Total
	Emergent	Forested	Scrub-Shrub	Unconsolidated Bottom	
Total					
No-Build					
2B-2/the Preferred Alternative	2	21	3		26 (0.2%)
5A2B-2	1.5	23	6	0.5	31 (0.3%)
5B2B-2	1	25	4		30 (0.3%)
Felts Brook Watershed					
No-Build					
2B-2/the Preferred Alternative	1	6	2		9 (0.6%)
5A2B-2	0.5	8	5	0.5	14 (0.9%)
5B2B-2		9	1		10 (0.7%)
Eaton Brook Watershed					
No-Build					
2B-2/the Preferred Alternative	1	12	1		14 (0.4%)
5A2B-2	1	12	1		14 (0.4%)
5B2B-2	0.5	13	3		16.5 (0.5%)
Meadow Brook Watershed					
No-Build					
2B-2/the Preferred Alternative		3			3 (0.5%)
5A2B-2		3			3 (0.5%)
5B2B-2		3			3 (0.5%)

3.1.2.5 Wild and Scenic Rivers

No wild and scenic rivers are present in the study area (National Park Service, 2008b).

The No-Build Alternative and the build alternatives would not impact wild and scenic rivers.

3.1.3 Vegetation

Forests in Penobscot County are dominated by two forest types: the spruce/fir group and the northern hardwoods group (USDA Forest Service, 2005). The spruce/fir forest type typically consist of species such as red spruce, black spruce, balsam fir, and northern white cedar. Eastern hemlock and white pine are also frequently occurring coniferous species. The northern hardwood forests in Penobscot County are typically dominated by sugar maple, red maple, yellow birch, beech, and poplar.

Approximately 28,538 acres of the study area is vegetated (exhibit 3.14), including approximately 22,736 acres (66.1 percent) of forest vegetation. The forested areas consist of approximately 16,894 acres (74.3 percent) of deciduous forest, 5,013 acres (22.1 percent) of mixed forest, and 829 acres (3.6 percent) of coniferous forest.

The net amount of forested land in Brewer has increased over time due to vegetational succession. Much of the forested land in Brewer has resulted from the abandonment of agricultural fields during the early part of the 20th century. Agricultural fields in this area were historically forested. These forested areas contain pioneer species such as birch, poplar, and cherry (City of Brewer, 1995). Areas of Holden and Eddington encompass much older forests than Brewer, dominated by species such as pine, spruce, eastern hemlock, and shade-tolerant hardwoods such as sugar maple and beech.

The No-Build Alternative would not impact vegetation.

The build alternatives would impact 102 to 136 acres (0.4 to 0.5 percent, respectively) of vegetation (exhibit 3.15). Deciduous forests would be impacted to a greater extent than other general types of vegetation. The total amount of vegetation in the study area impacted by each build alternative is less than one percent.

The build alternatives may create an opportunity to introduce invasive species to the study area. Roadside erosion-control plantings, drainage ditches, maintenance and construction fill, automobiles and boats traveling from areas infested by invasive species, and animals traveling along roadways provide a means for invasive species to disperse. Roadside erosion into wetlands and streams allows invasive species to gain a foothold as native vegetation is scoured or smothered by eroding soils. MaineDOT plants only native species on construction sites to reduce the spread of invasive species.

Some invasive species are damaging to ecosystems to which they are introduced; others negatively affect agriculture and other human uses of natural resources or impact the health of both animals and humans. Common invasive species found in Maine are oriental